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ABSTRACT

The study explored behavioral procedures for developing the skill of standing from a chair for a severely mentally retarded 11-year-old nonambulatory girl and an 86-year-old man residing in a nursing home for the elderly. Functional assessment and programing determined the specific instructional needs of each S. A changing criterion design was conducted to shape the hip and knee extensors for both Ss. Intensive habit shaping procedures of hip and knee extensors which facilitate standing were successful with each S; however, the retarded S took longer to develop the prerequisite strength for standing and required more extensive programing than the elderly S. Collateral effects for the retarded S included reciprocal functioning of the knee flexors to the knee extensors and the development of timing to integrate two basic motor components of the standing task. (CL)

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AUTHOR ABSTRACT
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Title: Teaching the Severely Mentally Retarded and Elderly to Stand

Abstract (up to 200 words): The purpose of this study was to explore behavioral procedures for the development of the skill of standing from a chair for the severely mentallu retarded and the elderly. Development of prerequisite muscular strength of the knee and hip extensors were necessary to enable independent standing to occur. Functional assessment and programming was used to determine the specific instructional needs of each subject. A changing criterion design was conducted to shape the hip and knee extensors for both the elderly and severely mentally retarded child. The intensive habit shaping procedures of the hip and knee extensors which facilitate standing were successful with each subject. However, the severely mentally retarded child took longer to develop the prerequisite strength for standing and required more extensive programming than the elderly person. A description of colateral effects of the program for the severely mentally retarded child are discussed.

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Transfer skills such as standing from chairs and ambulation are important prerequisites for independent domestic living. Hill and Brunicks, 1981, report that 42% of all severely mentally retarded public facility residents and 30% of all community mentally retarded facility residents have ambulation difficulties. Non-ambulatory severely mentally retarded individuals receive limited motor training (Haavick and Altman, 1977, and Hill and Brunicks, 1981) on transfer skills.

The two general types of research activity on standing describe activity of what a person does when they stand and training procedures to bring about behavioral change that lead to standing. Studies that have addressed training programs to develop standing behavior of the severely handicapped are limited in number (Loynd and Barclay, 1979; Walker and Voglesberg, 1985; Hester, 1981; and Wheeler, et al. 1985). Many techniques used to teach functional human transfer tasks use manual manipulation based on neurodevelopmental approaches and other stimulatory technique (Bobath (1964), Ayers (1973), Sullivan (1982).

There are also researchers who have investigated activity of standing (Laubenthal, K.N., et al., 1971; Kelley and Wood, 1976; Seedham and Terayama, 1976; and Bajd and Turk, 1982) which are descriptive of biomechanical movements and electromyography of specific anatomical joints. This information provides little information as to what the practitioner is to do in the process of habilitation or restoration of disabled persons or elderly persons.

Elderly and developmentally disabled persons are at risk of becoming dependent upon others in performance of activities of daily living. Both groups may benefit from the application of behavioral principles to programs to improve functioning of specific motor skills. When members of these populations are incapacitated in physical activities there is need for

restorative services for the aged and habilitation/education for the developmentally disabled .

The ultimate outcome for both groups is behavioral change for more independent functioning. Applied behavioral analysis embodies scientific procedures that can be validated as effective or ineffective when applied across subjects.

There are few studies which have targeted specific deficient prerequisite muscle groups for programming within the functional context of standing from a chair. There is a difference in building a prerequisite component of a transfer skill and development of the skill. The mission of this study was to develop hip and knee extensor muscles to such an extent that the body weight could be lifted autonomously from a chair.

The purpose of this study was to explore procedures for development of standing through the combination of integration of component movements and shaping related major muscles which were weak of the severely mentally retarded and elderly.

PROCEDURES

Subjects

The subjects of this study were a severely mentally retarded non-ambulatory girl 11 years old who was non-verbal enrolled in a Special Education class for the severely disabled and an eighty-six year old male who was unable to stand from a chair who resided in a nursing home for the elderly. Both subjects had been provided with services by physical therapists or physical therapist aides where prompting and neurodevelopmental techniques had been previously applied. The severely handicapped girl, when transferred

required that the body be lifted as dead weight. The elderly male required assistance from the staff to rise from the chair.

Training Area

The training area for the severely mentally retarded girl (Heather) was a self-contained special education class room with a chair (with a seat) 14" from the ground. The training area for the elderly subject (John) was his room in a nursing home and a chair which had a seat 16" from the ground.

Design

A changing criterion design (Kazdin, 1982) was used for this study. An entry level was determined as to the height of the buttocks above the seat of the chair on a stack of paper. The criterion was changed for lowering the buttocks until it rested on the chair.

Components of Functional Assessment and Programming

There are three fundamental assessments that must be made of a learner to efficiently conduct functional assessment and programming for the behavior of standing up. These three assessments are (1) task analysis of the component behaviors which must be chained together to master the task, (2) performance proficiency of the task after it has been learned for the purpose of generalization, and (3) analysis of the essential ability prerequisites necessary to perform each component of the task analysis (in this case adequate strength of the hip and knee extensors to raise the seat and trunk from the chair to a standing position). Each one of these components must be fully evaluated in each subject. The central focus of John's program was strengthening of the hip and knee extensors and then incorporating the strength into a functional

standing pattern. On the other hand, Heather's program required temporal-spatial chaining the components of the standing behavior and, training standing to criterion levels of performance to fulfill the development of prerequisites of adequate strength of the knee and hip extensors.

Baseline

Baseline data was taken to determine whether the subjects could stand from the chair. No responses were elicited over a period of 6 trials for either subject so it was determined that training was needed to raise each subject's seat from the chair. Furthermore, repeated attempts to assist the subjects from the chair with physical guidance failed. The severely mentally retarded child was in a school program in which neurodevelopmental techniques were applied by a physical therapist. The elderly person was not responsive to previous programming which utilized manual guidance.

Functional Assessment and Programming

An analysis of John's attempted standing behavior revealed an inclination to use the elbow extensors by pushing against the arms of the chair to lift and propel the center of gravity upward and forward. The combination of forces applied by the elbow extensors, knee and hip extensors was not sufficient to enable movement from the chair to a standing position. Therefore, the instructional decision made from functional analysis was to train the knee and hip extensors for restoration of strength that would enable him to stand in an upright position. Heather, on the other hand, had no prerequisites for standing except control of the trunk in a sitting position. Therefore, her program, based on functional analysis, required acquisition of

integrated movement skills of standing and intensive habilitation of the major muscle groups required for standing (the hip and knee extensors) which were obviously deficient. Clearly, the ability to make the response was not developed. The logical activity for the development of these deficient muscles for standing were simulated activities that involved standing from the chair.

Physical prompting and fading of the prompt is a method that is commonly used to develop non-functional behaviors. This procedure is relatively ineffective in the development of large muscles that are weak. Clearly, the acceptable procedures are progressive resistive exercise, which is a form of behavioral shaping. Thus, the programming aspect of the standing behavior was to shape the muscle strength of the hip and knee extensors through programmed instruction. In order to shape prerequisite muscle strength, it was necessary to find the present level of performance (entering behavior) upon which the shaping would occur. Before these muscles of the subject could be shaped, it was necessary to identify hierarchies which enabled the subjects to move from a level of proficiency to one that is outside of the performers capability through attainment of measurable objectives. In the case of developing the knee and hip extensors for the standing, the task needed to be broken down into small steps in which there would be more success than failure. Two hierarchies were identified as a result of the functional assessment that revealed deficiencies of strength of the hip and knee extensors. One was the height of the hips above the seat of the chair. The lower the hips to the chair seat, the greater strength was needed to move to an erect position. The other hierarchy was the number of repetitions or times that the standing behavior was to be performed to achieve an objective of standing from the seat of the chair which was modified in height.

Program Intervention

The program for Heather (the severely mentally retarded child) was conducted by placing her feet under the chair with a strong physical prompt. In the early stages of the program, one person was needed to physically hold the feet in the appropriate position to provide a base of support over which the weight of the body was moved. After two weeks in the program, physical prompts for feet placement were not needed and Heather could maintain the feet in the required position. The next part of the task required a stimulus prompt (Becker, et. al, 1971) with a tug forward of the arms to initiate a shift of weight of the trunk over the feet, at which time a thrust was made with the hip and knee extensors. If the thrust was too soon, the weight was moved to the back of the chair where it supported the trunk. Thus, the intent of the program (functional development of the knee and hip extensors) was invalidated because a true measure of the muscular involvement of the knee and hip extensors could not be determined to which shaping procedures could be applied. Within a week, Heather learned the techniques of timing the thrust to get proper activation of the target muscles.

The early training sessions of the project took ten or twelve minutes to get the 6 target repetitions because it was necessary to teach the building behavior upon which the shaping (changing criterion design) program was based. Once the target behaviors to be shaped were established the training regimen lasted approximately 90 to 120 seconds.

Description of the Treatment

The experimental treatment program for Heather was conducted two times daily with one training session at 9:00 a.m. and the other at 2:00 p.m. John's experimental program was conducted two times a day, once at 11:30 a.m.

and once at 6:30 p.m. The programs were conducted by placing a stack of 8½x11" folders on chairs with seats 14½" and 16" from the floor for Heather and John respectively. The stack of folders for each subject were at such heights that the hips were elevated above the seat of the chair so the legs could be straightened without assistance in moving the body weight upward. Six repetitions were performed on each training session. If the subject was successful in mastering the six repetitions, three folders. 15 of an inch in height were taken away from the stack for the subsequent day. This meant that the buttocks came closer to chair seat and more closely approximated the sitting behavior. This procedure was repeated five days a week for both the subjects until both could stand erect unassisted as a function of the strength component of the task.

The six trials two times a day (12 trials in all) was sufficient over-learning of the tasks to warrant the reduction of height of folder.

Entry Levels

The entry level of the height of the buttocks above the chair seat for each subject was established through a trial and error procedure. The task of the standing program was to stand erect from a quasi-seated position. The entry level of Heather's buttocks above the 14½" chair was 5.60 inches. The entry level of John was 2.55 inches above the chair with a seat which was 16" above the floor. A changing criterion shaping program from entry level was initiated for each subject. If the objectives were not mastered (consistent with shaping procedures) the increment of step size (0.15 of an inch) was not increased. However, this was not the case for either subject. The present level of performance of Heather and John each was the height of the stack of folders which were placed on the chairs that represented best performance.

Folders were withdrawn from the stack so the height was reduced each day. Thus the criterion was changed with respect to the amount of hip and knee extension required to execute the repititions. Calculated guesses were made on the increment of step sizes for each subject. Three to six folders (.075 to.15") were reduced for Heather and five to ten folders (.125 to .25 inches for John.

Interrater Reliability

Interrater reliability was calculated for the treatment of standing from a chair. The standing behavior was fairly complex and had to meet four criterion for mastery. They were as follows: (1) the feet had to be placed flat on the floor, shoulder width, with the heels under the front edge of the chair - (to activate equally the knee and hip of extensors of both legs (2) the weight of the trunk and hips must be at least over the feet at the moment of thrust of the hip and knee extensors, otherwise the trunk would fall back into the chair. (3) both legs must be fully extended after the upward thrust of the knee and hip extensors, (4) the weight must be placed on both feet after standing for one second (instructors prompt for balance), (5) there is no physical prompt used by the implementor to assist the subject with the raising of the buttocks to the standing position. Physical prompts are permissible for the purpose of balance. Any assistance in the upward movement of the body would destroy validity of the measures of the shaping process. Interrater agreements were collected on two occasions during baseline and three times during the treatment phase and once on the withdrawal phase. Interrater reliability scores were computed by the number of agreements of each repetition divided by the number of agreements plus the number of

disagreement times one hundred. Two observers were several feet apart and simultaneously and independently recorded the number of correct repetitions on each of the six trials of the program.

No standing responses were recorded during the baseline. Interraters agreement during the experimental phase of the study were as follows. First week were 83.3, second week 91.6, third week 91.6, fourth week 100, fifth week 100. For the elderly person, reliabilities were 100% for both the first and second week.

RESULTS

Figure No. 1 graphically displays progression of the buttocks moving closer to the seat of the chair until it rests on the chair. At this point the buttocks could be moved from the chair to a position over the feet with the knees and hips extended. Thus, the subject possessed sufficient strength of the hip and knee extensors to stand up. The data were recorded as the number of inches (nearest 0.10) the buttocks was above the seat of the chair which a subject could stand 6 times in a row without a rest.

Baseline

Neither subject could stand from a chair prior to treatment. Prompting techniques had previously been used in an attempt to achieve these behaviors by special educators and related service personnel in the case of Heather. Physical therapy aids and recreational personnel had previously conducted programs for John. Thus, treatment with traditional non-shaping procedures, were ineffective.

Treatment

The treatment phase of the experiment was initiated after determining the distance the base of the buttocks was from the seat of the chair for each subject. As can be seen by Figures No. 1 Heather's buttocks was initially 5.60 inches above the seat of the chair and John's was 2.55 inches above the seat of the chair. The buttock was supported by the stack of folders. The data shows initial objectives each day of .15" for Heather (reduction of the distance of the buttocks from the seat of the chair) and .25" for John. The increment of step size in the shaping process was made on intuition. Therefore, larger steps were prescribed for John. He was able to master the larger steps. Twelve training sessions were required for task mastery for John and 28 training sessions for Heather.

DISCUSSION

This study validated the efficacy of the application of behavioral principles for teaching the elderly and severely mentally retarded in need of developing muscle strength for standing. More specifically, it validated the appropriateness of the concepts of criterion of ultimate functioning Brown behavioral shaping Instructional Psychology (Lindvall and Bolvin, 1967) and Task Analysis (Bellamy, et. al. 1979).

Criterion of Ultimate Functioning

The persons of this study could not independently stand from chairs in the rooms in which they spent a considerable part of their lives. Therefore, to assist them with greater independence, an assessment of behaviors necessary for them to function in their environments were made. One skill which was identified was standing from a chair. Thus, an environmental assessment revealed that the height of the seats of the two chairs were different for an

elderly person and a young severely mentally retarded child. Thus, programming was designed individually so that each could improve functioning in a particular setting. The results of the study revealed that such an approach is feasible inasmuch as each person was functionally more independent in specific environments at the conclusion of training.

Behavioral Shaping

The behavioral shaping procedures which have been well established in the literature appear to be equally effective with the elderly disabled and the severely mentally retarded. This study further verified the generalizability of behavioral shaping of motor tasks across different types of populations. The skills of shaping the large muscles of the knee and hip extensors required more sophistication with the severely mentally retarded than the elderly in this particular case. Relearning a task, as was the case for the elderly person ,appears to be much easier than learning a new task altogether which was the case with the severely mentally retarded.

Application of Scientific Principles from Instructional Psychology

The scientific principles from the behavioral sciences Lindvall and Bolvin, (1967) applied to instruction were successfully validated in this study. Some of the basic principles that were applicable to this project are as follows: (1) work with clear objective, (2) programs should accommodate a wide range of abilities, (3) enable the learners to advance at their own rate, (4) individualized a program specifically to the needs of the individual, (5) utilize hierarchial curricula which enable measurement of progress and (6) integate assessment and programming.

Task Analysis and Programming

This study revealed that both task analysis and programmed instruction were effective for skill acquisition and improved performance for teaching standing. The task analysis of standing from a chair was more complex and required greater detail for Heather than for John. For Heather each component part of the task of standing up had to be developed and integrated so that the target muscle groups of the hip and knee extensors could be developed to fulfill the prerequisites of standing. On the other hand, John knew from previous experience how to stand and only needed minimal assistance in learning the skill. However, he needed strength development of the hip and knee extensors. To master the standing behavior, both the skill and the prerequisites to performance must be fulfilled.

The results of the study revealed that the use of a behavioral shaping procedure embodied in programmed instruction of the hip and knee extensors within the context of standing could improve functional standing behavior for both the severely mentally retarded and the elderly. Furthermore, the time frame needed to acquire mastery was different for each subject. However, through component analysis of weak muscle groups which were prerequisite to acquisition of standing, the muscle groups were able to be shaped through a criterion design which eventually led to standing behavior.

A Comparison of Techniques

This study was based on functional assessment and programming through task analysis, and identification of undeveloped prerequisites that prevented task success in standing from a chair. Programmed instruction was utilized through a shaping procedures to develop deficient strength of muscles prerequisite to standing. This procedure varied from those of Walker and Vogelsberg, 1985,

Loynd and Barclay, 1970, and Hester, 1981. These studies used intervention procedures that introduced external forces to assist the gross motor strength component of the standing behavior. One used a table to pull the body to a stand. Another used physical guidance which consisted of pulling the child up to a standing position. Such behavior circumvents shaping the musulature which is prerequisite to standing.

The intervention phase of the response component of the behavior in these studies differed from shaping prerequisite of deficient major muscle groups. Loynd and Barclay (1970) circumvented normal standing from a chair by shaping the movement of pulling the body to an upright position by use of a table. In the Walker and Vogelsberg (1985) study the response capability of standing was clustered with walking and standing was already developed. Verbal cues and gesture were used to communicate an appropriate response of a cluster of standing and walking behaviors. The child was pulled to an upright position with a subsequent fading procedure in which the hand was removed when the child first moved the buttocks off of the chair. All other prompting was for positioning and balancing (the perceptual components of the task). Thus, this study treated and measured primarily the physical strength prerequisite of the standing movement which required upward movement of the body. The perceptual components were then integrated into the prerequisite physical response as they were expressed in the functional task. Physical guidance has proven effective for teaching motor skills in which task components have response capability and only need be integrated for task success. However, the effectiveness of such a procedure for the development of prerequisites physical abilities as compared to progressive resistive exercise and shaping is unproven.

Collateral Effects

Meyer, et. al. (1985) alludes to the collateral effects of programming. In the case of Heather, there is impressive evidence that in the acquisition of the target behavior of standing from a chair, there were multiple positive affects. Because the collateral effects were unexpected there is no behavioral acquisition data. However, behavioral changes were observable and the collateral effects contributed to the development of strength of the hip and knee extensors for the functional purpose of standing from a chair.

Reciprocal Innervation of the Knee Flexor

The reciprocal innervation of muscles is important for coordinated movement. In the case of Heather, during the initial stages of the project, after standing, it was difficult to get her to flex the knees and hips so she could return to a sitting position in the chair for the next repetitions. Very strong prompts were required to get the knees to flex, (reciprocally innervate) a prerequisite for sitting in the chair. A considerable amount of instructional time was required getting the knees to flexed position. A technique was developed where the subject was lifted quickly by the investigator and another staff member quickly prompted flexion of the knees. This enabled the child to return to the sitting position. It became clear that reciprocal responding of the knee flexors, on return to sitting were improving at the beginning of the second week. By the end of the third week of the experimental phase, the need for prompting knee flextion on return to the sitting position was not needed. Thus, not only did Heather gain strength of the hip and knee extensors for the purpose of standing from a chair, but she also gained reciprocal functioning of the knee flexors to the knee extensors.

Timing Another Unanticipated Collateral Effect

Another unanticipated collateral effect of the standing program for Heather was the development of timing to integrate two basic motor components of the standing task. These components were (a) moving the trunk forward and (b) activating the knee and hip extensors.

Early in training, there were frequent occasion when the thrust of the hip and knee extensors to lift the hips was done too early in the task. The result was a thrust in which the trunk was thrown against the back of a chair. Stimulus prompts (auditory and kinesthetic) were provided when the forward movement of the trunk passed over the feet. These stimulus prompts enabled Heather to learn when to push with the legs in relationship to the transfer of weight over the feet. Thus, the integration of two prerequisite motor behaviors in a temporal spatial context fulfilled unexpected collateral benefit above and beyond the intent of the target program. There is no data that describes the acquisition of integration of these two component motor behaviors. However, it was clear to these researchers that the integration of these two motor responses which gave rise to functional standing behavior resulted from strengthening the hip and knee extensors.

Conclusion

The following conclusion can be made concerning the study for development and restoration of standing from a chair by the severely mentally retarded and elderly.

1. Functional assessment and programming are procedures that are effective for both elderly and severely mentally retarded persons.

2. The behavioral shaping procedures utilizing the changing criterion design are effective with both the elderly and the severely handicapped.
3. Individuals have different levels of functional ability. Thus, behavioral programming must be adapted to each person's specific needs through individualized behavior programming.
4. Functional skill development for some persons may require that the subcomponent of the skill be developed rather than the skill itself.
5. The amount of time that is required to teach the skill of standing depends on the individual's past experience and present level of functioning.
6. Each person is in need of a functional curricula that enable performers to progress at their own rate and acquire skills that are functional for them in their specific environment.
7. Shaping procedures may be successful when prompting and fading procedures fail.

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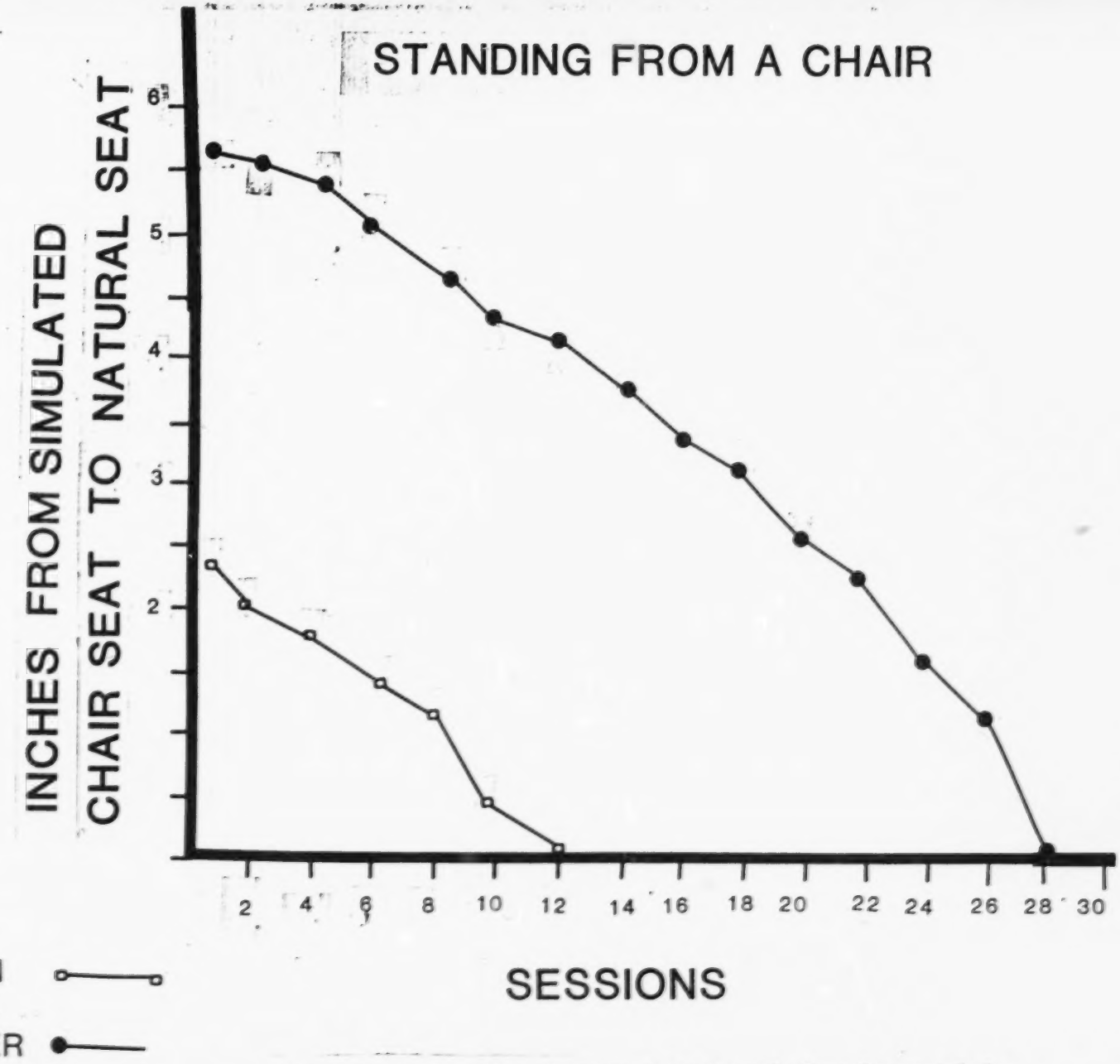

Figure No. 1 The number of inches of the buttocks from the seat of the chair in the natural setting. Each data point represents successive training sessions.

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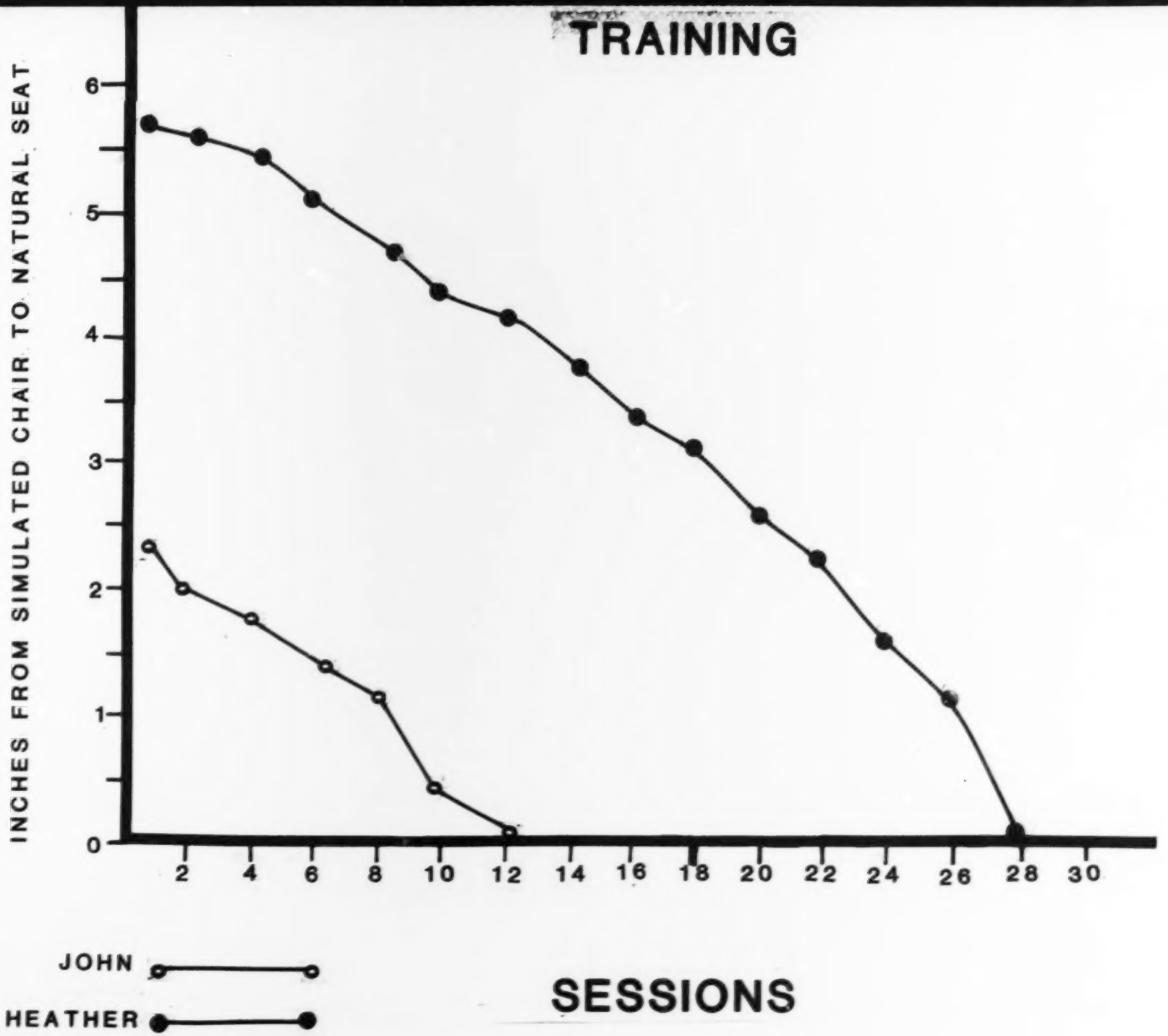

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